

Listing of the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1. (previously presented) A method of discrete multitone transmission of bits making up a plurality of frames, wherein each frame includes a plurality of frame bit positions, including:

allocating a respective number of bits to each of a plurality of discrete tones;

assigning the bits of each frame to the plurality of discrete tones such that each discrete tone is assigned the allocated respective number of bits and wherein a permutation mapping the bits of each frame to each of the discrete tones cycles through a sequence of different permutations in successive frames, wherein a bit in a frame bit position is mapped to a different discrete tone in a plurality of successive frame assignments;

generating for each frame a symbol comprising a plurality of discrete tones modulated to transmit the bits assigned to the respective tones; and

transmitting the generated symbols.

2. (canceled)

3. (Original) A method of data transmission according to claim 1 wherein a predetermined cyclic sequence of permutations is used in successive frames.

4. (currently amended) A method of data transmission according to claim 1 wherein there are n discrete tones, where n is an integer;

the i th tone is allocated to transmit $b(i)$ bits, where $b(i)$ is an independent positive integer for each of the n tones; and

in the j th frame each consecutive $b(n_{jk})$ bits starting from the first bit of the frame are assigned to the n_{jk} th tone in sequential order as k increases from 1 to n , where $[n_{j1}, n_{j2}, n_{j3}, \dots, n_{jn}]$ is a permutation of the first n positive integers $[1, 2, 3, \dots, n]$, wherein j is a frame within a sequence of frames.

5. (original) A method of data transmission according to claim 4 wherein the sequence of permutations cycles from an initial permutation through all possible permutations of the first n integers $[1, 2, 3, \dots, n]$ in successive frames before returning to the initial permutation to commence the cycle again.

6. (previously presented) A method of data transmission according to any preceding claim including:

for each of the discrete tones, generating for each frame an amplitude phase keyed constellation point representing the bits allocated to the tone; and

using an inverse discrete Fourier transform to generate a transmitted output signal from the amplitude phase keyed constellation points.

7. (original) A method of data transmission according to claim 6 wherein the amplitude phase keyed constellation points are quadrature amplitude modulation constellation points.

8. (original) A method of data transmission according to any preceding claim wherein the bits are trellis coded.

9. (currently amended) A discrete multitone modem for transmitting a stream of bits making up a plurality of frames, wherein each frame includes a plurality of frame bit positions, comprising:

a tone generator for assigning the bits in each frame to a plurality of discrete tones such that each discrete tone is allocated a predetermined respective number of bits, wherein a permutation mapping the bits of each frame to each of the discrete tones cycles through a sequence of different permutations in ~~successive~~different frames, wherein a bit in a frame bit position is mapped to a different discrete tone in a plurality of successive frame assignments;

a constellation point generator for generating a constellation point for each tone representing the assigned bits; and

an inverse discrete Fourier transform module for generating an output signal including the plurality of discrete tones from the constellation points.

10. (currently amended) A discrete multitone modem according to claim 9 for use with n discrete tones, where n is an integer, wherein

the tone generator includes a bit allocation table allocating $b(i)$ bits to the i th tone, where $b(i)$ is an independent positive integer for each of the n tones; and

the tone generator assigns in the j th frame the first $b(n_{j1})$ bits of the bit stream to the n_{j1} th tone, and each subsequent $b(n_{jk})$ bits are assigned to the n_{jk} th tone in sequential order as k increases from 1 to n , where $[n_{j1}, n_{j2}, n_{j3}, \dots, n_{jn}]$ is a permutation of the first n positive integers $[1, 2, 3, \dots, n]$, wherein j is a frame within a sequence of frames.

11. (original) A discrete multitone modem according to claim 10 wherein the

sequence of permutations cycles from an initial permutation through all possible permutations of the first n integers $[1, 2, 3 \dots n]$ in successive frames before returning to the initial permutation to commence the cycle again.

12. (previously presented) A method of receiving data divided into frames, the data being generated by assigning the bits of a bit stream, having a plurality of frames, to discrete tones and mapping the bits of each frame to the discrete tones by cycling through a predetermined sequence of different permutations in successive frames; wherein the method includes the steps of:

receiving a sequence of symbols, each symbol frame including a respective number of bits on each of a plurality of discrete tones;

decoding the received symbols according to the predetermined sequence of different permutations to regenerate the bit stream, wherein the predetermined sequence of different permutations maps a bit in a frame bit position to a different discrete tone in a plurality of successive frames.

13. (currently amended) A method according to claim 12 wherein there are n discrete tones, where n is an integer, the i th tone being allocated to transmit $b(i)$ bits, where $b(i)$ is an independent positive integer for each of the n tones; the method comprising the steps of

obtaining for each frame (j) the permutation $[n_{j1}, n_{j2}, n_{j3}, \dots n_{jn}]$ of the first n positive integers $[1, 2, 3 \dots n]$, and

regenerating the frame by taking the first $b(n_{j1})$ bits of the frame from the decoded n_{j1} th tone, and the subsequent bits in order from the decoded n_{j2} th tone, the n_{j3} th tone until the last bits are taken from the n_{jn} th tone, wherein j is a frame within a

sequence of frames.

14. (previously presented) A discrete multitone modem for receiving a stream of symbols representing a plurality of frames, comprising:

a discrete Fourier transform module for generating constellation points corresponding to a plurality of discrete tones contained in each received symbol; and

a tone decoder, wherein the tone decoder is configured to decode the received symbols according to a predetermined sequence of different permutations to regenerate an original bit stream, wherein:

each discrete tone is allocated a respective number of bits, the allocation of bits to discrete tones cycles through the predetermined sequence of different permutations, and

the predetermined sequence of different permutations maps a bit in a frame bit position to a different discrete tone in a plurality of successive frames.

15. (previously presented) A method of data transfer of bits of a bit stream making up a plurality of frames across a link, wherein each frame includes a plurality of frame bit positions, comprising:

allocating a respective number of bits to each tone;

assigning the bits of each frame to the plurality of discrete tones such that each discrete tone is assigned the allocated respective number of bits, wherein a permutation mapping the bits of each frame to each of the discrete tones cycles through a sequence of different permutations in successive frames, wherein a bit in a frame bit position is mapped to a different discrete tone in a plurality of successive frame assignments;

generating for each frame a symbol comprising a plurality of discrete tones modulated to transmit the bits assigned to the respective tones;
transmitting the generated symbols across a link;
receiving the transmitted symbols from the link; and
decoding the received symbols according to the predetermined sequence of different permutations to regenerate the bit stream.

16. (currently amended) A method according to claim 15 wherein there are n discrete tones, where n is an integer, the i th tone being allocated to transmit $b(i)$ bits, where $b(i)$ is an independent positive integer for each of the n tones; and

the step of mapping tones to bits assigns in the j th frame the first $b(n_{j1})$ bits of the frame to the n_{j1} th tone, and each subsequent $b(n_{jk})$ bits are assigned to the n_{jk} th tone in sequential order as k increases to n , where $[n_{j1}, n_{j2}, n_{j3}, \dots, n_{jn}]$ is a permutation of the first n positive integers $[1, 2, 3 \dots n]$, wherein j is a frame within a sequence of frames.